SCIENTIFIC AMERICAN

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Flying Cage and Ducks' Aviary.

Reptile House.

The Elk Range.

Alligator Pool and Jungle.

Rounding Up Buffaloes.

The Aquatic Birds' Aviary.

Interior of the Reptile House.

THE NEW YORK ZOOLOGICAL PARK RECENTLY OPENED TO THE PUBLIC.—[See page 10.]

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Scientific American.

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RETROSPECT OF THE YEAR 1899.

Looking back over the year that has just drawn to a close, the American who has the interests of his country deeply at heart will find abundant cause for satisfaction. It has been a record of unqualified prosperity.

OUR EXPORTS.

The year 1898 saw the success of our arms, and the advancement of our naval and military prestige; its successor has witnessed an equal and more pleasing triumph in the arts of peaceful industry. With rapid strides we have moved up to the front rank as a great exporting nation, and not only have we easily held our own and strengthened our position in those lines of manufacture in which we had already made a good beginning, but we have gained a secure foothold for our products in new territory which was supposed to belong exclusively to our foreign competitors. It is unnecessary to multiply instances, and it is sufficient to refer to the construction of the Atbara bridge in the Soudan and the shipment of American locomotives to England, as instances of the fact that our industrial methods enable us to build so cheaply, so expeditiously and so well, that we can lay down a manufactured article in Great Britain or her possessions in less time, at less cost, and of equally serviceable quality as the British firms themselves. Our exports of electric railway equipment have grown enormously, the important new London underground roads and the Glasgow corporation tramways coming to this country for their material and equipment. American locomotives and American bridge work, indeed, are becoming familiar the world over, the latter going abroad in increasing numbers to Japan and China, while the contracts for English engines find their counterpart in an order for twenty locomotives for the Saxon State Railways of the German Empire. The Soudan episode has been repeated in Burma, where an American firm offered to build in one year for $300,000 a bridge for which the most favorable English tender asked $590,000 and three years time to complete. The instances quoted are a few among many which indicate the vast possibilities of the future, among which we may reckon the ultimate advancement of this country to the position now held by Great Britain as the greatest trading nation of the world, with New York as the world's commercial center.

OUR EMPIRE.

The problems of colonial (for the want of a better word) administration, remaining to us as a legacy of the Spanish war, have been solved, during the year, with a reasonable measure of success. In Porto Rico, as the result of the devastating hurricanes of last summer, our efforts have been chiefly in the way of relief for a starving peasantry; and the cry is still for help. In Cuba our efforts have been largely directed to the cleaning up of the accumulated filth of the cities, and such relief of the impoverished country as could be accomplished. The absence of political disturbances after the perpetual strife of Spanish rule indicates that, so far as outward appearances go, the pacification of the island is complete; but it is too early to judge of the practical results of our government or to determine how long our occupation of the island must continue. The splendid work already accomplished by General Wood at Santiago is a good augury for the future of the island under its newly appointed governor. In the Philippines, if we may judge from the reports of General Otis, the insurrection is practically at an end, the insurgent army broken up and dispersed and Aguinaldo a fugitive. The problem in these far distant islands is big with possibilities, and its solution will call for the most careful consideration. In some respects it is as difficult a question as ever confronted an American Congress. If the administration of these islands be carefully safeguarded from the worst features of political influence, we have no doubt that the Philippines will be pacified and rendered in due time extremely prosperous under American rule.

CIVIL ENGINEERING.

The record of the year in the sphere of civil engineering is remarkable as much for the works proposed as for those accomplished, although we must make a notable exception in the case of the great Chicago Drainage Canal, which is now practically completed, and the new St. Lawrence Canal locks, which, by making it possible for ocean steamers 270 feet in length to pass between the Great Lakes and the Atlantic, will place the Great Lake cities in direct communication by water with the Atlantic seaboard. The Chicago Drainage Canal, primarily intended to carry off the sewage of Chicago, is one of the greatest canals ever constructed. It has a depth of 22 feet of water, with a maximum width of 202 feet, and its total length is 35 miles. It has cost over $33,000,000, and the total excavation, including the river diversion, is over 43,000,000 cubic yards. Another canal of less dimensions but great historic interest completed and opened last year is the Dismal Swamp Canal, 10 feet deep, 80 feet wide, and 22 miles long, which will enable vessels to go south from Norfolk by the inland route, avoiding the dangers of Cape Hatteras. The Panama Canal has been prosecuted steadily throughout the year, and with the Nicaragua Canal and other proposed canal routes across the Isthmus is being made the subject of investigation by a United States commission, with a view to selecting the best location for a national canal. The most important hydraulic works in the hands of British engineers are the great dam at Assouan on the Nile and the barrage at Assouat. About 8,000 men are employed on the former work and 12,000 men at the barrage. When this work is completed, a large area of the Nile Valley will be brought under cultivation, with a corresponding increase in the wealth and prosperity of that historic country. The opening of the railway to Khartoum, the death of the Khalifa and the final dispersion of his army, events which marked the close of the year, are all important steps in the rehabilitation of the devastated regions of the Upper Nile. The most important water works in course of construction in the United States, the Croton Dam, for the supply of New York, and the Wachusett Reservoir, for the supply of Boston, have been pushed forward during the year, the Croton Dam being now within two years of completion.

Early in the year the Great Boston Terminal Station, the largest structure of the kind in the world, was opened for traffic, and the important work on the Philadelphia Subway and Tunnel, involving an expenditure of $6,000,000, has been pushed to completion. In New York city a start has at last been made in the matter of rapid transit, and the awards will shortly be made for the construction of the tunnel road. The new East River bridge has so far progressed that the tower foundations are completed and the two anchorages nearly so, while the steel work for the towers and approaches is being delivered and the contracts for the cables have been closed. Two other bridges across the East River to cost respectively $13,000,000 and $15,000,000 are to be commenced, unless the present Controller of New York succeeds in substituting his proposed tunnels as an alternative and more economical scheme. Indeed, tunnel schemes of great magnitude are very much in evidence just now, for in addition to those suggested beneath the English Channel and the Irish Sea is one to connect Europe and Africa at the Straits of Gibraltar—of which it is sufficient to say that it is as little likely to be built as the other two. The most important harbor improvement of the year is the cutting of a 40-foot channel into New York Harbor. The contracts have been let, and work is being pushed on a set of mammoth suction dredges, similar to those which have done such good service at the mouth of the Mersey, Liverpool. Work during the year has been prosecuted with feverish energy on the Trans-Siberian Railway, which with its European connections will have a total length from Atlantic to Pacific of about 6,700 miles.

MECHANICAL ENGINEERING.

There have been no very notable developments in the field of mechanical engineering. The water-tube boiler continues to advance in favor, as do superheating and mechanical stoking. Central stations are growing in size and in the bulk of the separate units. The most striking instances of this are to be found in this city, where three mammoth stations of from 70,000 to 100,000 horse power total capacity are under construction. The separate engines vary from 6,600 to as high as 10,000 indicated horse power, something altogether unprecedented outside of the engine room of an Atlantic liner. In the smaller classes of steam engine we notice a distinct revival of interest in the rotary engine, much of which no doubt is due to the stimulus of the steam-driven automobile, for which a successful rotary engine would be the ideal motor. If the rotary type is ever successfully applied to the automobile, it will probably be in the form of a steam turbine, with worm gearing to reduce the speed of revolution to the desired rate. The light weight of the turbine in proportion to its power, its perfect equilibrium, great range of expansion, and silent exhaust, would seem to render it an ideal motor for the purpose. Meanwhile both the Parsons and the De Laval machines are extending their field of operations, and Parsons turbines are being built or planned of from 1,000 to 1,500 horse power. According to Prof. Thurston, we must not look for much further development in the steam engine, as it has been so far perfected that but little more in the way of economy can be expected of the designer, recent tests of a pumping engine, carried out by the college over which Prof. Thurston presides, having revealed an efficiency, measured against the perfect engine of Carnot, of 84 per cent and a duty measured on a basis of 1,000,000 B.T.U. of 163,000,000 foot-pounds.

ELECTRICITY.

The year's progress in the electrical world has been marked by steady advance along established lines, with few or no startling inventions or discoveries to be recorded. Perhaps the most striking development has been that of wireless telegraphy, a system which was shown for the first time in successful commercial operation in this country by Marconi himself during the international yacht races. During the summer wireless messages were successfully transmitted between ships of the British navy which were separated by 80 miles of water, and decipherable messages were also dispatched from Chelmsford in England to Boulogne in France, over 110 miles of land and water. Marconi has done enough to establish the practical value of his system for certain specified work; but its value will be enormously increased if he can discover some means to restrict the receipt of messages to the particular station for which they are intended, and prevent all interference by the waves sent out from other stations that may happen to be within range. Scarcely less remarkable results in their way have been attained by the Pollak-Virag system of high-speed telegraphy; from 70,000 to 100,000 words per hour having been transmitted between Budapesth and Vienna, while recently as high as 122,000 per minute were transmitted between Chicago and Buffalo. In this system transmission is effected by a perforated strip of paper, as in the case of the Wheatstone automatic, while a telephone fitted with two small mirrors serves as the receiver, the diaphragm of the telephone being set into oscillations corresponding to the current impulses generated by the transmitter. The SCIENTIFIC AMERICAN has devoted considerable space during the year to descriptions of the electrical development of the Niagara water power. The close of the year sees the first half of the proposed 100,000 horse power plant of the Niagara Falls Power Plant nearing completion, and steps being taken to duplicate the existing power house with another of equal capacity on the opposite banks of the company's feeder canal. The Hydraulic Power Company has an output of about 14,000 horse power, and improvements are under way which will increase this to 20,000. The Canadian Niagara Power Company is to commence work shortly on the development of 10,000 horse power, and altogether it may be said that the much talked of "harnessing of the falls" as far as it has gone has proved a technical and industrial success. Electricity continues to oust every other form of power for the operation of street railways, and the indications are that for city work the underground trolley will be the exclusive system, with the overhead trolley for suburban and short interurban lines. At the same time the third rail has given such good results on the New Haven Railroad that it is not improbable that the Shore Line from New Rochelle to Harlem will be equipped with a third rail. The electric equipment of steam railroads, however, is not proceeding as quickly as many people had expected, although the great system of the Manhattan Elevated is to be electrically equipped, an order for several thousand tons of third rail having been placed during the year. Another change from steam to electricity that has been determined upon, is the equipment of the Metropolitan Underground Railway in London. In this connection mention must be made of the excellent economy shown last year by the electric lines of the Metropolitan Street Railway Company in this city, which cost for operation per car mile 11·95 cents as against 17·96 cents for the horse car roads, and 17·99 cents for the cable roads. A service of compressed air cars has been started on two crosstown lines of this company, but it is too early to make any comparison of results with the electric or cable roads.

STEAM RAILROADS.

Transportation, as represented by the gigantic railway system of the United States, has to record a healthy growth, and the age of wild-cat railroad construction has doubtless gone for good. The present total length of our roads is 184,532 miles, and our advance is now recorded year by year, not so much by added mileage as by improved rolling stock and roadbed, more commodious stations, a faster time card, and a slowly (too slowly) lessening casualty list. Locomotives and freight cars continue to increase in size, though not so noticeably as they did last year. The fast transcontinental mail trains have called for and produced some exceptionally powerful express engines with boilers of unusual capacity, and the big freight engines of over 100 tons weight of the preceding year were followed by others of even greater weight and power last year.

The steam locomotive still holds the field as *par excellence* the traction motor for heavy or long distance

trains, the Heilmann electric machine notwithstanding, and there is no evidence that it is likely to be displaced. The fastest trains in the world during the year were those run during the summer season on the Pennsylvania and the Philadelphia and Reading roads, from Camden to Atlantic City. These trains, whose schedule speed is between 60 and 70 miles an hour, frequently made the runs of 55·5 and 58·3 miles at rates of from 68 to 74 miles an hour, with trains weighing as high as 290 tons. The palm for the fastest regular express service, however, must be awarded to the great French railroad Chemin de Fer du Nord, which is unapproached in the number and average speed of its fast trains. The service includes no less than 45 trains with a running speed, including stops, of over 50 miles an hour, and of these no less than 10 are timed to run at speeds of from 54 to 60 miles an hour. The service is worked by four-cylinder compound engines.

THE AUTOMOBILE.

Unquestionably the greatest advance in transportation is that recorded in the field of the automobile, which is evidently destined to enjoy a popularity as great as, and certainly more lasting than, the bicycle. There has been a noticeable and very gratifying improvement in the general appearance of the latest styles of automobile which have made their appearance during the year, and the constantly accumulating experience is leading to marked improvement in the motors. The field is no longer all but exclusively occupied by the gas engine and the electric motor; for the improvements in steam motors has been so great as to promise that this long established, well understood and easily managed form of power may yet become the most popular for the automobile, with compressed air a possible rival. The speed and "radius of action," to borrow a naval term, of the automobile have seen a truly remarkable increase during the twelve months. A remarkable proof of this was shown in the nine-day race around France, in which the winner covered the distance (1,428 miles) in 44 hours, 44 minutes, 9 seconds, an average speed of about 32 miles per hour. Special racing machines have made speeds on the track of over a mile a minute. Another machine has covered 85 miles in 7¼ hours without recharging, and in a trial against the Paris-St. Malo express, two automobiles covered the distance, 226 miles, in 7 hours and 35 minutes, the train taking 13 minutes longer. The progress of the industry in this country has been decidedly encouraging. The latest models of American automobiles compare favorably with the best European makes, and we look for the industry to make very rapid strides during the present year.

THE BICYCLE.

As the star of the automobile rises, that of the bicycle seems steadily to set. The latter will never cease to be used for business and pleasure; but the popular rage, which is already on the wane, will be increasingly transferred to the automobile as the price of the latter comes more and more within the reach of the purse of the average citizen. The introduction of motor-pacing has enabled some remarkable speeds to be accomplished on the bicycle, a mile having been ridden in 1 minute and 19 seconds on the track, the cyclist using a chainless wheel. Speaking of paced riding, a striking evidence that the atmosphere presents the principal resistance to a bicycle moving at high speed was afforded by the ride of a mile in 57⅘ seconds made during the year by a rider paced by a locomotive. This was done on a prepared plank track laid specially for the attempt. The most noticeable improvement in the bicycle has been in the introduction of coaster brakes, and of other forms of brake applied to the rear wheel. Beyond this there has been but little change as compared with the model of the previous year.

NAVAL.

In naval affairs there has been no cessation of the efforts of the maritime nations to increase their already stupendous fleets. The SCIENTIFIC AMERICAN has devoted particular attention to this subject during the year in a series of articles entitled "The Navies of the World." A preliminary comparison showed that the United States, at the commencement of 1899, stood fourth in power and numbers, with Germany a close fifth. Unless we make more strenuous efforts, however, we shall soon have fallen to fifth place, for the present German programme calls for the expenditure of nearly $200,000,000 on naval construction, the amount to be made available in yearly installments as needed. We think that a similar scheme, calling for the construction of so many battleships, cruisers, etc., each year, would produce better results than our present haphazard methods, in which the growth of the navy is dependent from year to year upon the caprice of our legislators. It is worthy of note that Great Britain has now under construction for her own navy warships whose total tonnage is 488,000 tons, or more than the total tonnage of the whole United States navy. France and Russia, moreover, are making relatively large additions, and Japan, whose navy is now entitled to rank as of the first class, is a liberal patron of the best European yards. We cannot afford to stand still.

The United States navy has received some notable additions during the year. The battleships "Kearsarge" and "Kentucky," carrying the much discussed superposed turrets, passed satisfactorily through their trials, in each case exceeding the contract speed, and the "Alabama" made 17 knots on her builders' trial. The "Wisconsin" and "Illinois" are also nearing completion, and the three battleships of the "Maine" class are well advanced. The three battleships of the "New Jersey" class and the 13,500-ton armored cruisers of the "California" type are "held up" by the refusal of Congress to allow the purchase of necessary Krupp armor. The new monitors are being constructed at a leisurely pace, and the contracts have been let for the construction of the six semi-protected 16½-knot cruisers of the "Denver" class. These monitors and cruisers will prove to be among the most unprofitable investments of money ever made, rivaling in this respect the "Vesuvius" and the "Katahdin." Our torpedo-boat fleet is growing apace, the vessels coming fairly well up to contract requirements. In foreign navies the effect of the improved Krupp process is seen in the lightening of armor, and its distribution over a larger area of the ship's side, the latest battleships of the "Duncan" class for the British navy carrying only 7 inches of armor on the side. The weight saved in armor shows itself in the engine and boiler rooms, for these vessels are to steam 19 knots with natural draught. The water-tube boiler has been adopted for our navy and will be used, we believe, exclusively in our new battleships and cruisers. The speed of all warships, from the 15,000-ton battleship to the torpedo boat, continues to increase. Schichau, of Elbing, has achieved over 35 knots on an 18½-mile course with the torpedo boat "Hai Lung," built for the Chinese navy, and Parsons of turbine fame is reported to have realized 37 knots in preliminary trials of an enlarged "Turbinia," although this latter needs verification. The submarine boat has been very much in evidence during the year, chiefly because of the increased attention paid to it by the French government and the very succesful trials of the "Holland" in this country.

The manufacture of the new long-caliber guns at Washington has been carried on with gratifying results. The new 50-caliber 4-inch gun has given a velocity of about 3,000 feet per second, with a moderate chamber pressure. A new, multi-perforated, all-gun-cotton powder is being made, which will give equal velocities with a pressure not to exceed 16 tons in the powder chamber. Experiments with high-explosive shells, especially in the case of a new explosive, "joveite," have been highly successful. A shell loaded with the latter substance, and weighing 523 pounds, penetrated a 14·5-inch Harveyized plate without breaking up.

THE MAGAZINE RIFLE IN WARFARE.

The progress of the South African war has proved that the modern magazine rifle is *par excellence* the weapon of the future in military operations. Although the British infantry have proved their ability to storm unintrenched or partially intrenched positions, as at Glencoe, Belmont, and Gras Pan, the repulses at Magersfontein and the Tugela, where the Boers had thrown up elaborate intrenchments, proved that direct assault on such positions, when held by such excellent shots as the Boers, are doomed to failure. The magazine rifle has put a heavy discount upon old-time valor, and the war of the future will be more than ever a war of the tacticians.

MERCHANT MARINE.

The most notable event in the merchant marine was the placing in service of the "Oceanic," of the White Star Line, the first of the modern vessels to exceed the dimensions of the "Great Eastern." As compared with the earlier vessel she is 12 feet longer, and she has 1,500 tons more displacement, while her sea speed is 20 knots as against about 13 knots for the "Great Eastern." The "Kaiser Wilhelm der Grosse" continues to reduce her own record, having made the trans-Atlantic passage last year at an average speed of 22·56 knots. She also ran in one day 580 knots at the rate of 24·17 knots an hour. The Hamburg-American Line will shortly place in service an answer to the "Kaiser Wilhelm" in the "Deutschland," a 686½-foot ship, which, with 35,000 indicated horse power, is to maintain an average sea speed of 23 knots an hour. This places the 5-day passage well within reach. The tragic loss of the "Bourgogne" has stimulated the munificent offer of the Pollok prize of $20,000 for the best device for saving life at sea. That other notable disaster, the loss of the "Paris," served to demonstrate the strength of the modern system of ship construction; for after lying for 52 days on the rocks of the stormy Cornish coast, this fine vessel was floated, and will eventually return to her duties upon the New York-Southampton route. "Roller" boats have yet to achieve the speeds promised by their inventors. The "Ernest Bazin" has been sold, and has found her legitimate sphere of activity as a show-ship, while Knapp's roller boat is resting on its laurels, with a record of having rolled 41 miles in 5 days.

AERONAUTICS.

Activity in the aeronautical world has been directed rather to the development of the airship than the aeroplane. Ever since Langley's brilliant success in achieving a flight of three-quarters of a mile with an experimental, steam-driven, machine, we have heard but little, either of the motor-driven aeroplane, or the soaring machine. The balloonists, on the other hand, have been very active, and fairly successful. By far the most ambitious attempt at the construction of an airship is that of Count Zeppelin, whose mammoth machine, over 400 feet in length, was to have made its trials in October.

ARCHÆOLOGY.

Although archæology cannot this year report such sensational discoveries as have rendered some previous years famous, gratifying results have been attained in Rome, where the much-explored site of the Forum still yields up its secrets to the antiquarian pick and spade; while in Egypt, thanks to the Egyptian Exploration Fund, over two thousand historic and prehistoric graves have given up their treasures for the enrichment of modern museums. Had they been living friends instead of "senseless" stone, the fall of the great columns at Karnak could scarcely have caused more sincere regret than was felt throughout the civilized world when this disaster was made known.

GEOGRAPHICAL AND SCIENTIFIC EXPEDITIONS.

Never was there a time when so many and so well-equipped expeditions were abroad in the effort to fill in the blank spaces in the geography of the world. Interest is divided pretty equally between the Arctic and Antarctic regions — with a preference for the former. Peary is well on his way to the North Pole. Profiting by his past experience, he is engaged in establishing the necessary line of communications before making his final dash for the objective point. He has an able competitor in Sverdrup, Nansen's old colleague, who has taken the "Fram" once more into Arctic waters, with the intention of combining Peary's and Nansen's plan of advance in a supreme effort. During the year Abruzzi has set out, and Wellman has returned from Franz Josef Land. The Belgian Antarctic expedition, which sailed from Antwerp over two years ago, has brought home a fine collection of fauna and many valuable data gathered during its deep sea investigations; while the Geographical Society of Berlin has under consideration the dispatch of a well-equipped expedition. Mention should be made also of Prof. Hatcher's exploration of Patagonia, which has yielded valuable results, and also of the exploration of the fossil beds of Wyoming, which has proved so successful that another expedition is being planned for this year.

CHEMISTRY.

After being crucified by its friends, liquid air has been attacked by the vultures. Liquid air promoting is the order of the day, with capitalizations at $10,000,000 the company, and sales of stock at the rate of $2.50 a share.

Prof. Dewar again holds a prominent place in the history of the year's progress. To the long list of his achievements has been added the liquefaction of hydrogen, the first public exhibition of the new substance having been made at the Royal Institution, London, in June of this year. Subsequently, at the Dover meeting of the British Association, he described the experiments by which he had succeeded in solidifying the same gas. Early in the year, MM. Curie and Bremona announced through Dr. Becquerel to the Academy of Sciences at Paris, the discovery of a new, supposedly elementary substance, to which they gave the name of "radium," and in May Sir William Crookes informed the British Royal Society that he had found in a photograph of a spectrum a group of lines indicating the existence of a new element, which in honor of his Queen he named "victorium."

Electric lighting has recorded no developments worthy of special mention, for great as were the expectations based upon the new Nernst lamp, they have not been fulfilled. Acetylene, on the other hand, has fully justified expectations, and both as an illuminant and a source of motive power it is giving excellent results.

OBITUARY.

Limitations of space prevent a lengthy reference to the obituary of the year, which includes the names of men who can ill be spared from the fields on which they have left imperishable monuments of their labors. In the death of Prof. O. C. Marsh, American science suffered the severest loss since the death of Prof. Cope. Of that distinguished German, Prof. R. W. E. Bunsen, it is sufficient to say that in the last half century it is scarcely possible to find another whose contributions to science have been greater in their total practical effect. The death roll of American scientists also contains the names Dr. Daniel G. Brinton, the ethnologist, Hamilton Young Castner, celebrated for his work in the chemical arts, and the naturalist, Elliott Coues; while Canada has been robbed of the geologist Sir William Dawson. Of technical experts, the army and navy have lost Gen. D. W. Flagler and Lieut. R. B. Dashiell; and Great Britain, Vice-Admiral Colomb. Sir Douglas Galton in England and Mr. Frank Thompson in America were two of the best known engineers of the day. The names of William H. Webb, the shipbuilder, and Ottmar Mergenthaler, the inventor of the "linotype" machine, complete a death-roll as illustrious as it is long.

LANDSLIDE AT AMALFI.

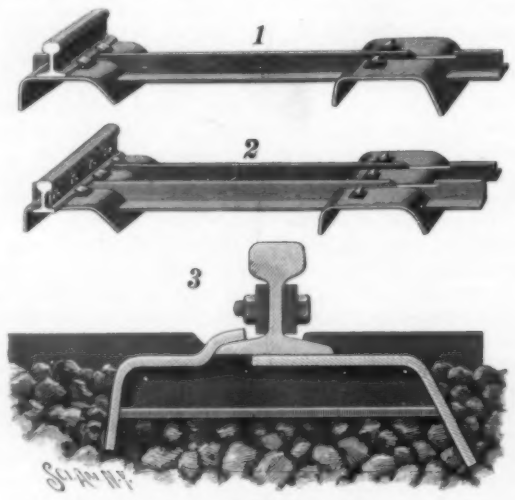
A landslide occurred December 21 at Amalfi, on the Gulf of Salerno, Italy. Many houses and the Capuchin monastery were destroyed. The landslide dashed the whole building on the houses below, and all were in turn hurled into the sea, burying four smacks that were moored in the bay. At first it was thought that the loss of life was very severe. Fortunately it was found that only ten were killed and quite a number injured. The accident is attributed to the recent heavy rains. Troops and engineers from Naples and Salerno were hurried to the spot. Fortunately many of the visitors had gone up to Rome to witness the imposing ceremonies of the Christmas season at St. Peter's, or the fatalities would have been much larger. The residents were naturally greatly frightened, especially as another landslide threatened to overwhelm them.

It really seems as though in that country nature chooses the most beautiful spots for the manifestation of her power. Witness Vesuvius, Etna, Ischia, and now Amalfi. Amalfi is one of the two or three most picturesque spots in Italy and is probably exceeded in beauty only by the Bay of Naples itself and Taormina. Our two engravings give an admirable idea of this wonderful place. Amalfi is not far from Sorrento and lies on the southeastern side of a high rocky point which extends out toward the island of Capri. It has a most interesting history, being mentioned for the first time in the sixth century, when it enjoyed the protection of the Emperor. It afterward became an independent State under the presidency of a Doge. The town was continually at variance with the neighboring princes, and defied all the sovereign States in the neighborhood until King Roger reduced the place in 1131. Amalfi assisted in a war with the Pisans, and it was during this struggle that the celebrated manuscript of the Pandects of Justinian fell into the hands of the Pisans. The sea began gradually to undermine the lower part of the town in the twelfth century, and a terrible inundation, in 1343, proved still more destructive, and after that period Amalfi steadily declined.

It was really the Athens of the middle ages, and it can boast of having given birth to Flavio Gioja, who is said to have invented the compass in 1302. In a hollow of a rock, 400 feet above the sea, stood the ancient Capuchin monastery which was destroyed. It contained fine cloisters, a charming veranda, and magnificent points of view. A large grotto which will be seen to the left was formerly used as a Calvary or series of devotional stations. The whole front of the great rock is covered with vineyards, and donkeys wind their way among the tortuous lanes, going up and down the frequent flight of steps with sure-footedness. A trip to this "dependence of the Albergo dei Cappuccini" on the Marina is not altogether enjoyable, owing to the dreadful pest of beggars, all the streets and lanes being infested with them, and the only hope of future comfort is never, under any circumstances, to be tempted to give anything to a beggar in Amalfi, for if the tourist once does this, he is lost and can go nowhere without a horde of ill-kempt and persistent beggars. The open loggia covered by vines gives one of the most inviting views in the world and certainly makes one of the most picturesque photographs conceivable. An examination of the general view of Amalfi shows better than any description how a landslide could have occurred.

THE CHESTER METALLIC RAILWAY TIE.

The time is coming when our forests will no longer be able to fill the enormous demands of railway companies for ties. But even though there may be no signs of a decreased production, the metal tie is gradually supplanting the old wooden sleeper. Its greater cheapness and durability, and its smaller weight, more than any sentimental desire to preserve our forests, have been the chief cause of its adoption on many American railways.



THE CHESTER METALLIC RAILWAY TIE.

Our attention has been drawn to a steel tie in which these elements of cheapness, strength, and lightness are even more prominent than we have been accustomed to find them in metallic sleepers. The tie in question is the product of the Philadelphia Railway Track Equipment Company, Stephen Girard Building, Philadelphia, Penn., and has been very successfully used on the Huntingdon and Broad Top Mountain Railroad, Pennsylvania.

The Chester tie, as it is termed, is a T-shaped bar six feet in length passing through correspondingly-shaped slots in bearing-plates upon which the rails rest, and having hook-shaped rail-seats. The bearing-plates, it will be observed, have each two depending legs, one on each side of the rail and parallel therewith. Upon their upper flat surfaces the bearing-plates are provided with two lugs engaging and clamping the inner flange of the rail. The lugs, acting in conjunction with the hook-shaped rail-seats holding the outer flange, fasten the rails so firmly in position that spreading or lateral strain is resisted.

Perhaps the most noteworthy feature of the tie is its simplicity. There are but three parts, and these are locked together without the use of bolts, rivets, keys or wedges. As a result of this simplicity, a road can be laid with astonishing rapidity. The oppositely-disposed lugs and hooks impart strength to the tie and insure the maintenance of a constant gage. By reason of the slotted connection between the bearing-plates and the tie, the accidental separation of the parts is prevented. The small weight and compactness effects a considerable saving in the cost of transportation.

Fig. 1 is a main line tie, and Fig. 2 is a joint tie, in which two L-shaped bars are used on opposite sides of the joint, with a middle lug lapping the rail at the joint. Fish-plates, it will be observed, are discarded. Standard gage ties weigh from 69 to 119 pounds; joint ties (standard gage), about 160 pounds.

Confectionery in Army Rations.

Candy has been added to the regular ration of the American soldier. One New York firm has shipped more than fifty tons of confectionery during the past year for the troops in the Philippines, Cuba and Porto Rico. The government buys candy of good quality, which would retail from 30 to 40 cents a pound. It consists of mixed chocolate creams, lemon drops, cocoanut maroons and acidulated fruit drops. These are put in sealed one pound cans of a special oval shape, designed to fit the pockets of a uniform coat. According to The Evening Post, the use of candy as an army ration originated in some experiments on the diet of the troops conducted by the German government ten years ago. They showed that the addition of candy and chocolate to the regular ration greatly improved the health and endurance of the troops using it. Since that time the German government has issued cakes of chocolate and a limited amount of other confectionery. The Queen has just forwarded 500,000 pounds of chocolate in half-pound packages as a Christmas treat for the troops in the Transvaal. American jam manufacturers are considering a movement to add jam to the army ration. It has been found so wholesome for the British army that 1,450,000 pounds have been dispatched to South Africa as a four months' supply for 116,000 troops.

THE loss of life on the Great Lakes during the last season has been about a hundred. Fifty-six persons were lost by the foundering of ships and thirty-two were lost overboard. No passengers were lost on any of the regular lines.

AMALFI—GRAND HOTEL OF THE CAPPUCCINI, RECENTLY DESTROYED BY A LANDSLIDE.

VIEW FROM THE TERRACE OF THE HOTEL.

MECHANICAL ORE UNLOADER.

BY WALDON FAWCETT.

The men who are striving for the development of the iron and steel industry of the United States seem close upon the consummation of another innovation which will prove vastly important, quite as important in its way as any which have preceded it. In every step of the process from the time the ore is taken from the ground until it is placed in the furnaces, from which it is to emerge as pig iron, vast improvements have been made. So complete has been the evolution of economic methods that the producers of iron and steel some time ago came to the conclusion that the only stage at which it would be possible to effect any considerable saving of time would be in the transference of the iron ore from the ships which bring it down the Great Lakes to the cars which carry it to the furnaces.

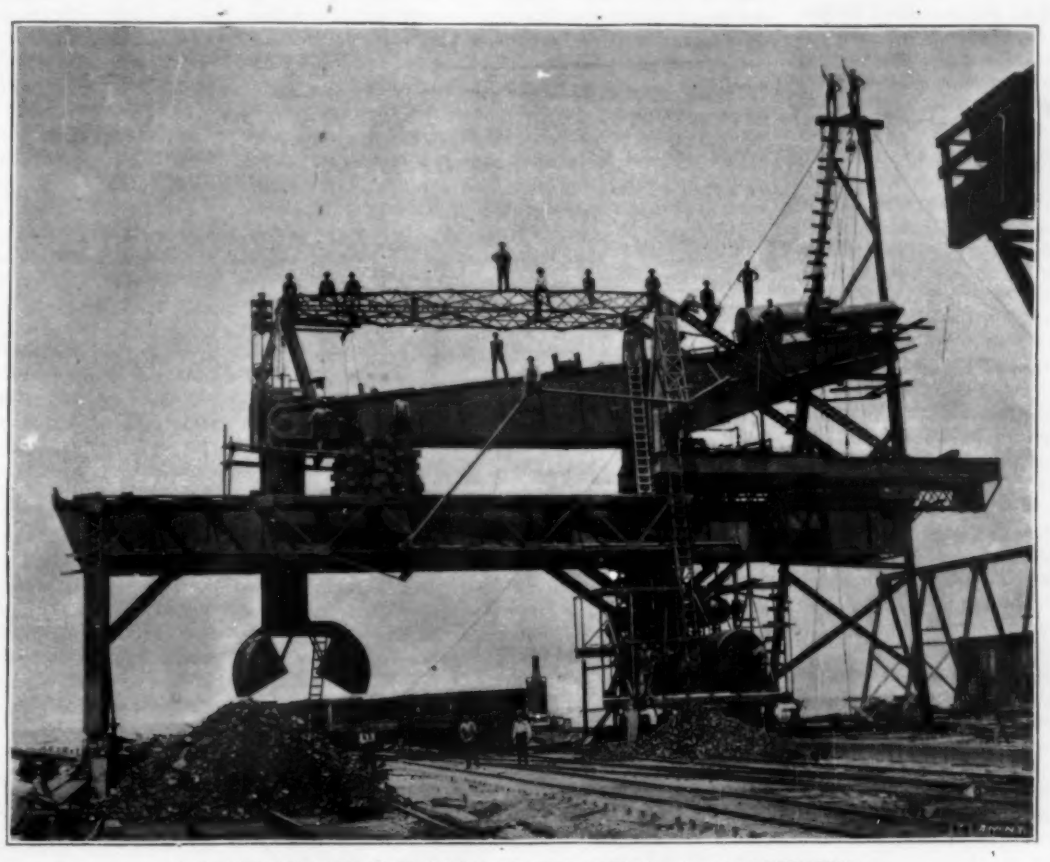
It is not intended in the foregoing remarks to disregard the cheapening influence which has been exerted by the larger lake ships and the cars of greater capacity which have come into service within the past few years, but they may truthfully be said to constitute a factor separate and apart. The manner in which cargoes are transferred to and from ships at ports on the Great Lakes has long been the wonder of engineers from all parts of the world and in this system, the unloading of iron ore, by means of huge buckets, traveling at a high rate of speed on bridge tramways extending from the ships to cars has been one of the devices which excited the greatest admiration. Still it did not entirely satisfy the iron ore men. They saw coal shippers in possession of a device which picks up a loaded car, empties its contents into the hold of a vessel and returns the car to the track, all in the space of a minute, and they call for something correspondingly speedy.

This, in a nutshell, indicates the conditions which brought about the invention of the mechanical ore unloader. The first of the type has recently been installed on the docks of the Carnegie Steel Company, at Conneaut, O., which Andrew Carnegie has announced his intention to make the greatest ore unloading port in the world.

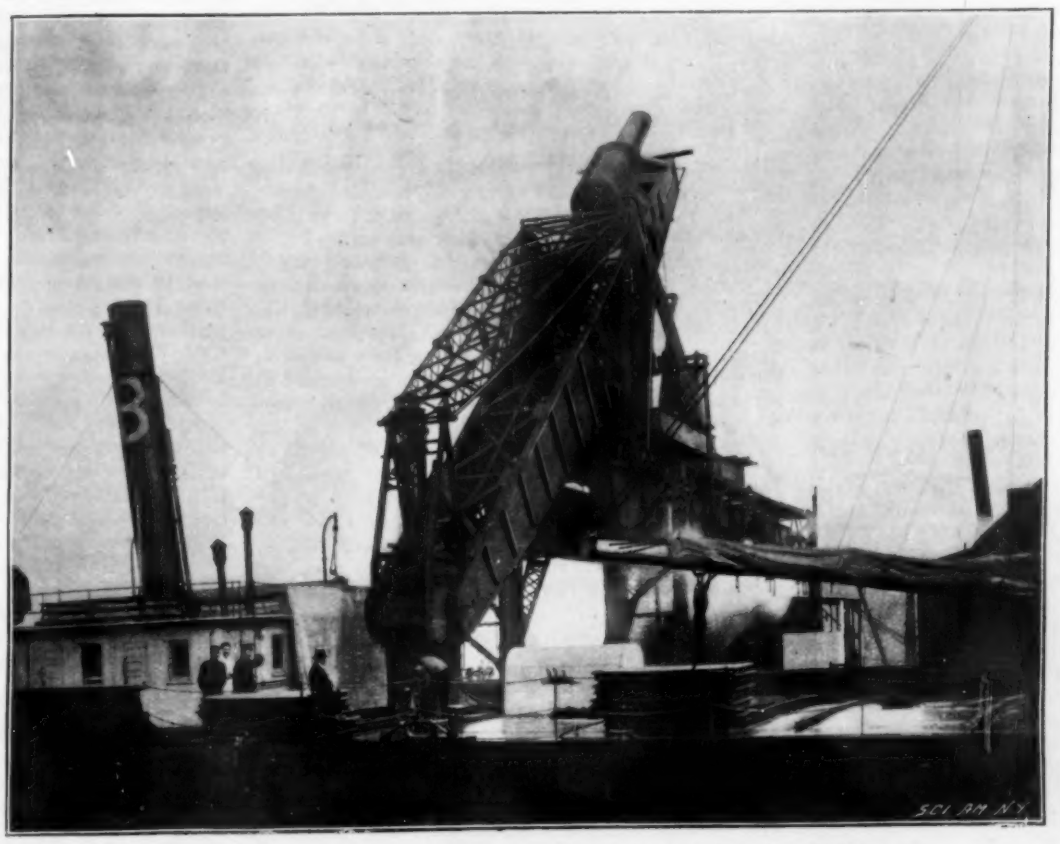
The new machines will, from the very outset, displace large forces of men who have been employed to load the ore into the large iron buckets which, under the present system, carry it from ships to cars. In passing it may not be amiss to say a word regarding these men, who perform, probably, the most arduous manual labor to be found anywhere. Only the hardiest of men can meet the exactions of the work, even temporarily. They work in gangs of twenty-five or thirty men, and their working day often has a length of eleven or twelve hours, in which time a workman of average ability will earn from $4 to $6. One of the greatest hardships of the work is the excessive heat found in the holds of the great steel ships, in which, of course, very little ventilation is possible.

The shovel of the machine, which has just been installed, is of the clamshell type and has a capacity of fully ten tons of ore. The shovel, which is operated by a hydraulic cylinder, is attached to a mast which revolves in a complete circle and in which an operator is stationed. By means of the walking-beam to which it is attached the mast is run out over a boat, lowered through a hatch, and turned in any direction, its radius being about nine feet, which enables the scoop to reach the bilge of any vessel on the lakes. After the shovel has been closed it is lifted from the hatch and run back over the cars into which it is desired to load the ore.

The whole machine is of heavy steel structure, with principal members of plate girder construction. The machine of course travels lengthwise on the dock while the heavy walking-beam traversing the top of the main structure moves at right angles to the dock.



MECHANICAL ORE UNLOADER—IN THE COURSE OF CONSTRUCTION.



MECHANICAL ORE UNLOADER—REMOVING ORE FROM A VESSEL.

The depending leg or mast is always kept in a vertical position by means of a parallel motion. The bucket end of the walking-beam is counterbalanced by means of the hydraulic accumulator located at the opposite end.

The movement of the whole ponderous machine lengthwise of the dock is accomplished by means of a pair of engines geared to the wheels on each main leg of the structure, and this facilitates to a considerable extent the loading of the lake steamers, which are provided with from ten to twelve hatches. It will thus be seen that it will be possible to put several of these machines to work on one boat or simply one machine may be employed and moved from hatch to hatch.

All the movements of the machine other than the one just noted are accomplished by hydraulic power through suitable cylinders. All the operating levers are grouped in the depending leg or mast, in which, as has been explained, the operator is stationed, and thus he at all times travels with the machine, his position being directly above the bucket.

The clamshell bucket will not only discharge its contents into hopper cars on either of the two railroad tracks at the front of the dock but may, if it is desired, be made to empty into a hopper at the dock in case it is desired to stock the ore. This hopper may either be drawn back and dumped into a storage bin, or its contents transferred to a tram car capable of being drawn back on the conveyer bridge.

These conveyer bridges are a novel feature of this new system of unloading iron ore. The bridges are of wood and rest at either end on towers placed on regular standard gage railroad tracks. In order to ease the strain of the long span of the bridges they are supported in the middle by a trestle. The ore is taken from the holds of vessels by the new machine and placed in side dumper iron cars, each of which is capable of holding about three tons of ore. The cars are propelled by hand along the bridges and dumped onto stock piles below. On the Carnegie Company's dock there are nine wooden bridges, each one hundred and fifty feet in length, and in the rear of these are located three bridges, each seventy-five feet in length. The arrangement of the bridges is such that the three last mentioned may be placed in the rear of any of the first mentioned bridges, thus making a continuous run of two hundred and twenty-five feet in case it is desired to stock ore on piles at a considerable distance back from the water front.

Hydraulic power for all the movements of the machine except the traveling along the dock is provided at a pressure of seven hundred pounds by means of a duplex compound pressure pump and steam accumulator. It is claimed that the machine will handle about three hundred tons of ore per hour from boats to cars, and that it will take out from ninety to ninety-five per cent of all the ore in the hold of a vessel. Only two men are required to operate the machine, while three men are employed to clean up the remnant of ore which cannot be caught by the shovel.

It will thus be seen that with three or four such machines at work unloading a vessel the ore would be removed from her hold quite as expeditiously in proportion as it is loaded at the ports on Lake Superior, where by means of elevated docks with pockets and chutes it is possible to load one of the largest vessels in three or four hours. The construction of the mechanical unloader presented many perplexing engineering problems, not the least of which was that of guarding against any injury to the ship from the operation therein of so ponderous a machine. Not all of these questions have even yet been fully determined, but there is little doubt that the season of 1900 will demonstrate the thorough practicability of this very interesting labor-saving machine.

AN International Congress of Mining and Metallurgy will be held in Paris the middle of June next, and a large attendance is expected.

Correspondence.

The Extermination of the Buffalo.

To the Editor of the SCIENTIFIC AMERICAN:

After perusing "The Crime of a Century," written by Prof. Charles Frederick Holder, published in the SCIENTIFIC AMERICAN of December 9, 1899, I am of the opinion that his article is a product of sympathy and love of natural existence. There is no doubt that had the Professor gone deeper into the question of extermination, he would have arrived at an entirely different conclusion. I will endeavor to correct some of the errors of Eastern antiquarian sympathizers by giving, from a practical and scientific standpoint, the opinion of men who have watched the decline and fall of the bovine race, and noted the progress of westward expansion.

From the authority of an army officer, Prof. Holder, speaking of the buffalo, said, "If any one had told me then that in twenty or thirty years they would have become almost entirely extinct, I should have regarded the statement as that of an insane person." Had he said, "If any one had told me then that in twenty or thirty years those vast plains would have become peopled by the human race, laid out in homesteads and ranches, with a church on every hill top, and a school in every valley," who would not have regarded the statement as that of an insane person?

In obedience to the philosophy of the survival of the fittest, the van of Western emigrants sounded the knell of the buffalo herds.

After considering the treatment of a few army officers, by being corraled for days and weeks on the open plain or in some gulch, or of some Kansas Pacific train derailed by their terrible onslaughts, what rational mind could look with favor on a great herd of probably a million buffalo charging madly upon every settlement and line of fence from Minnesota to Texas? Think of a million buffalo on their semi-annual migratory tours charging through your own country with their rank and file extending in every direction as far as your eyes can behold, your buildings, gardens and fields ground to dust beneath their myriad feet, your wives and children fleeing for protection at the sound of their approach. I wonder how the professor would like to have the pleasure of witnessing such a spectacle from the heights of the Catskill Mountains. Yet, such would have been the condition of affairs on the Western plain to-day had not the buffalo been exterminated. Had he not succumbed to the crack of the sportsman's rifle, his doom would have been sealed a short time later, when man came to dispute his claims.

After the buffalo had performed his act in aiding and assisting in the development of the country, his skin paid the expenses of his removal. Some may ask: Why was he not domesticated? In a country where land produces from 40 to 100 bushels of corn, and 1 acre of pasture land would put on 200 to 400 pounds of beef in a year, would it pay to raise animals whose chief value lies in their covering, estimated at $2.50 to $5? No! Decidedly no! Their domestication would have proved unprofitable.

On the broad prairies, stretching from the Mississippi River to the foothills of the Rockies, there exists in a state of domestication a race of animals far superior to the buffalo in quantity and ability to supply the wants of mankind. Where once roamed unfettered the pioneer of the prairies, now graze in quietude countless flocks of sheep and herds of cattle. Enough buffalos still remain for museum purposes.

If the Professor desires to witness a specimen of the successor of the buffalo, I refer him to Armour Rose, a Hereford heifer that sold at Kansas City for $2,500. She holds the place of one extinct buffalo. In the study of the history of human progress, when any animal becomes useless or inferior to other animals of its class and species, it is not only natural, but right, that their race give way to the survival of the fittest. A moderately small herd of buffalo on the Missouri River would be as entirely out of place as a band of Comanches turned loose on the Hudson.

The white man, by his industry, energy, and superior mental ability, has robbed the Indian of his birthright. No rational mind can entertain any other conception than that the buffalo were exterminated in direct obedience to the laws of nature. Their extermination was not a crime, but a necessity.

Ford City, Mo. GERALD LIVERGOOD.

A Decision Affecting Forfeited Applications.

The Court of Appeals of the District of Columbia has held, in the case of Christensen v. Noyes (C. D. Ms. Dec. 472), that where an applicant has permitted his application to become forfeited by failure to pay the final fee within the time prescribed by law, but has subsequently renewed the same, the constructive reduction to practice afforded by the filing of the original application will not defeat a patent granted to another before the renewal, upon an application filed subsequently to the filing of the original application, where the subsequent applicant was the first to conceive the invention and was also the first to actually reduce the same to practice. Applicants should therefore be careful not to allow their applications to become forfeited after allowance, but should see to it that their applications are diligently prosecuted until the final grant of the Letters Patent.

THE EXPLOSIVE SIDE OF ACETYLENE.

BY FREDERICK H. M'GAHIE.

In a recent number of the SCIENTIFIC AMERICAN SUPPLEMENT, the writer gave, under this heading, a summary of the facts that scientific investigation had determined in regard to the explosive properties of pure acetylene and its mixtures with air. These experiments have given the limits within which the new illuminant must be produced and utilized to avoid dangerous and uneconomical conditions. Some cases deviating from those treated possess much interest in having found practical application and having been studied from the point of view of possible explosion. Special burners have to be used with pure acetylene, as the ordinary ones do not give satisfaction with regard to illumination or economy. There is a deficiency in the supply of oxygen afforded by their construction, and combustion with them is not sufficiently complete to give rise to the temperature needed to carry to incandescence the large amount of carbon contained in acetylene. The first solution consisted in making the burners with holes permitting air to be drawn in and mixed with the acetylene just before combustion (Fig. 1). Such would act satisfactorily for a time and then begin to clog up and give a weakened, smoky flame. By adding 15 to 30 per cent by volume of nitrogen to acetylene, Bullier was able to employ ordinary burners. Others have proposed carbon monoxide, carbon dioxide, hydrogen, water-gas, as diluting agents. Of these, Prof. V. B. Lewes, Gas Engineer for the City of London Authorities, has stated: "The great trouble which has presented itself in diluting acetylene with any cheap diluent is that the illuminating power of acetylene is reduced to an enormous extent, and it has been found that hydrogen, carbon monoxide, and water-gas are useless for this purpose, as 10 per cent of acetylene mixed with either of them gives a practically

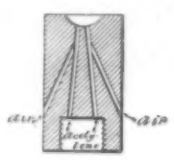


Fig. 1.

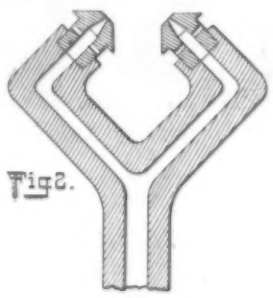


Fig. 2.

non-luminous flame, while if the acetylene is used in sufficient quantity to give a satisfactory light, the percentage of acetylene needed is too high to be commercially possible."

Prof. Lewes made a long series of experiments to discover a cheap diluent that "would maintain the enrichment value of acetylene at something near the value of the gas when burned alone." His conclusions were that "methane was the only gas that would do the work required, and further that the presence of 30 per cent of methane when mixed with hydrogen, carbon monoxide, or water-gas converted it into an excellent diluent, with which 10 per cent of acetylene gave a 20 candle-power gas capable of being burned in ordinary gas fittings." He found that each 10 per cent of diluting gas mixed with acetylene raised the temperature necessary to originate explosion 180° F. The practical value of this investigation lies from our point of view in the fact that a mixture containing enough acetylene to make a brilliant illuminant for railroad lighting can be compressed and utilized safely, since the temperature needed to cause explosion is high enough to melt the metal cylinders carrying the compressed gas. Such a system has been introduced with satisfaction on the street railways in Prussia. The preliminary tests were made by the Julius Pintsch Company, of Berlin, and the Prussian railway management in common. The conclusions of Berthelot and Vieille in regard to the explosiveness of acetylene were confirmed by these experiments. A tank was filled with acetylene at six atmospheres pressure, and a small pipe entering the tank was brought at a point 59 inches from the tank to a red heat by a gas flame. A violent explosion followed. Another tank was filled with acetylene at a pressure under two atmospheres and a pipe heated as before at a point 59 inches from the tank to a white heat. Local decomposition took place in the pipe, but no explosion occurred. With mixtures of 30 per cent acetylene and Pintsch oil gas or coal gas compressed to as high a degree as was desirable, it was found that the fusible solder used in the joints of the tank would melt long before a temperature involving explosion of the compressed gas could be reached, and, further, that explosion did not result from heating highly the pipes leading to tanks so filled.

For the small generator involved in the lighting of country houses by acetylene, the above methods are not available, and pure acetylene must be burned to secure a maximum simplicity of system. There are now satisfactory burners based on the principles of the one shown in Fig. 2. The escaping acetylene draws in air for mixing with itself, and the two jets impinge upon each other to form a vertical flame at a distance from the burner sufficient to avoid the overheating of the tops, with the consequent formation of the condensed polymers of acetylene, such as C_6H_6, C_8H_8, that causes smokiness and clogging up with the burners of Fig. 1 type. It has been proposed to mix air in proper porportions for good combustion in usual gas fixtures with the acetylene after its generation and a simple apparatus to this effect has been patented by Dickerson. But it involves an element of danger in introducing an explosive mixture into the distributing part of the system. The air can be mixed with the acetylene all right in the small passages of the burner, since the explosive laws of large masses do not hold in small tubes. Le Chatelier found that in tubes with diameter not exceeding 0·02 inch any mixture of air and acetylene would not propagate explosion. The influence of the diameter of tubes is shown in this table determined by him:

Diameter.	Inferior Limit of Inflammability.	Superior Limit of Inflammability.
	Percentage Acetylene.	Percentage Acetylene.
0·03 inches.	7·7	10
0·08 "	5·0	15
0·78 "	3·5	55
1·57 "	2·9	64

There are some who hold that compressed, and even liquefied, acetylene has a future. For compressed acetylene gas Claude and Hess have brought forward a method possessing distinct advantages, that of dissolving acetylene in acetone. At 60° F. acetone dissolves about 26 grammes of acetylene per liter, for each atmosphere of pressure, the factor decreasing with elevation of temperature. Berthelot and Vieille investigated this case to determine the conditions of explosion. They found that the acetylene gas above the liquid acted the same as pure acetylene and would, therefore, detonate by a spark at two atmospheres and above. At pressures up to 10 atmospheres, the acetylene dissolved in the acetone will not explode either through the detonation of the free gas or through the action of a highly incandescent wire placed in the liquid. Above 10 atmospheres a danger region is approached. In experiments at 20 atmospheres pressure inflammation of the free gas gave rise to an explosive pressure of 550 atmospheres. Since the decomposition of acetylene at 20 atmospheres would give around 200 atmospheres pressure, it is evident part of the dissolved acetylene participated in the action. When the inflammation was provoked by an incandescent wire in the liquid part, a pressure of about 5,000 atmospheres was observed. In using cylinders charged according to this system it is imperative to take into account the fact that the pressure increases rapidly with the temperature. In the charged cylinder experimented with, a pressure of 6·5 atmospheres at 57° F. became respectively 8·4 atmospheres at 80° F., 10·2 at mospheresat 96° F. and 15·8 atmospheres at 140° F. It is desirable then in using acetylene dissolved in acetone to fix the charging pressure at 7 to 10 atmospheres calculated for 60° F. in order to obviate the danger of charged cylinders reaching through exposure to the sun or through being in the vicinity of some source of heat a pressure at which the dissolved acetone would take part in any explosive decomposition. These figures have been given to exhibit the great increase of storage capacity afforded by the system. A cylinder of one liter capacity carrying 0·7 liter of acetone saturated with acetylene at 7 atmospheres pressure will carry 127 grammes of acetylene. The same cylinder will contain but 11 grammes of acetylene gas compressed to 10 atmospheres. If explosion should occur in the free gas of a cylinder properly charged, the maximum pressure obtainable would be below the safety limit of the cylinders employed and the dissolved acetylene would be still available. The advocates of this acetone-acetylene method hold that it gives an excellent solution of the problem of storing acetylene in a condensed state in cylinders for subsequent transportation to any place where it is desired to feed a receiver, that it is more economical and safe than acetylene compressed in the ordinary manner, and that it is practically free from all danger in the hands of the skilled workmen who would handle the cylinders. Those who believe in the possibilities of liquefied acetylene have invented valves which make it impossible for ignorant workmen to open them too quickly and to bring about thereby the danger of adiabatic compression in the gaseous column to a degree involving explosion.

THE French government is building four submarine boats of the "Goubet" type. Several submarine boats of the type of the "Narval" are also to be constructed if the trials which are now in progress prove satisfactory.

Science Notes.

Prof. Edward Orton has been appointed State Geologist of Ohio, to succeed his father, the late Edward Orton. Prof. Orton is a thoroughly competent geologist, and since 1894 he has been director of the department of clay making and ceramics in the Ohio State University. We have already published in SUPPLEMENT, No. 1248, an illustrated article by Prof. Orton on his remarkable ceramic school.

A pharmacy has been opened in New York city which is entirely different from the ordinary drug store. Nothing is sold in it except appliances, apparatus and drugs, etc., which are intended for the relief and comfort of the sick and invalid, and all the time and attention is devoted to the compounding of prescriptions, the examination and analyses of substances for physicians and their patients, and, in fact, says The Pharmaceutical Era, it is the exemplification of a thoroughly modern scientific pharmacy. It contains also a novelty in the way of a pharmaceutical library. Simple chemical processes in operation are displayed in the window.

The Division of Botany of the United States Department of Agriculture is at work to reduce the importation into the United States of some of the little things which have been costing the Americans $8,000,000 annually. Western States are now growing chicory. In 1896, 16,317,388 pounds were imported, but in 1898 only 315,707 pounds of raw chicory were imported. The Division in Botany is also making tests to protect farmers and merchants against foul and fraudulently imported seeds and test the importations of the department before distribution. The current SUPPLEMENT contains an elaborate résumé of the work carried on by the department during the past year.

Henry Savage Landor, traveler and author and now lecturer, has arrived in this country. We had the pleasure of reviewing Mr. Landor's remarkable book in our SUPPLEMENT, No. 1197, and we dare say there will be many in this country who will be pleased to hear Mr. Landor's remarkable adventures in Thibet from his own lips. He is only thirty-three years old, and since he was a very young man was fond of going among strange peoples. He has been in China, Japan, Kamchatka, the Kurile Islands, Mongolia, Australia, India, Nepal, Thibet, and Northern Africa. His adventures in Thibet are, of course, most thrilling. We learn that Mr. Landor went to Thibet last summer, but had no serious trouble.

An Austrian savant has declared that the human brain contains a "name center." He says that it is the office of this cell to retain names. A striking case which would seem to confirm this theory recently occurred at Cleveland. A brakeman was shot by a conductor, and the former could not remember the names of persons or things, although he could perfectly well describe the functions of all articles exhibited to him. The surgeon probed for the bullet and found it in the exact spot necessary to affect the remembrance of names, according to the Austrian's theory. When the pressure on the brain had been relieved, the patient remembered names as well as he had done before his injury and told the name of his assailant.

The French Commissioners of the Paris Exposition propose to make the official catalogue an interesting example of French taste in printing and bookbinding. It will be practical in size and contents and will not be expensive. It will be composed of eighteen volumes, one for each group in the general classification. Each volume will contain a general plan of the Exposition and a special one of the group to which the book belongs, the latter plan enabling visitors to find at once any desired exhibit. For each class the volume will contain a historical notice of the productions of that class, a catalogue of the retrospective exhibition, catalogue of French and foreign exhibits and an alphabetical list. The matter is to be furnished by persons specially competent to deal with the subject. The new catalogues will undoubtedly prove most valuable and will be in marked contrast to those which have been issued at the last International Exposition.

A recent paper read before an English society deals with the chemical effect of a high tide on 30,000 acres of Essex soil. The salt water injury lasts, according to various authorities, from five to twenty years. After the water had run off, it was found that there was two per cent of the salt in the soil, twenty times the normal amount, but not directly injurious. The damage seems to be chiefly due, says Engineering, to the entire destruction of the earth worms. The 1898 crop was very poor, and this spring the state of the soil was also very unsatisfactory, still earth worms began to appear, and nine-tenths of the salt has been washed out by rain. Apparently the clay has become gelatinous, owing to the action of the chlorides on the silicates, the silicate of alumina remaining behind, while the other silicates are greatly reduced in percentages. The proper treatment seems to be to plow in green crops, dressing with lime and potash and manuring.

Engineering Notes.

Most railway lines have a large percentage of their cars equipped according to the provision of the safety appliance act, but there are only six lines which are able to report that all of their cars are so equipped.

In Russia in the principal towns fire engines are used which were manufactured by British, Swedish and German firms. The Swedish engines are much cheaper than either the English or German machines.

Coal mining is developing rapidly in Canada. In Nova Scotia both the areas worked and the number of mines show a great increase. The coal areas of Canada are estimated at 97,200 square miles, not including areas known but as yet undeveloped in the far north.

In Japan a railway train was blown from a bridge on October 6. The train consisted of two locomotives, three freight cars, and four passenger cars carrying eighty passengers. While crossing an iron bridge the whole train, with the exception of the locomotives, was blown from the bridge into the stream below.

The Philadelphia Commercial Museum is asking an appropriation of $200,000 from Congress, to be used to collect samples and data in foreign countries for the use of our manufacturers, to employ experts in foreign ports for the extension of American trade and for the publication and free distribution of all the information collected to every chamber of commerce and board of trade in the country.

There are now three Scherzer bascule bridges across the Chicago River, one being a four-track railway bridge, while the others are highway bridges. Two other bridges of this type are to be erected to replace the old swing bridges. The center piers are to be removed in order to give the river the necessary capacity of flow required for the Chicago drainage canal.

The Hamburg-American line and the North German Lloyd are each having two new vessels fitted with ice-making and refrigerating machinery. In addition to the usual cooling rooms and ice-making plant, two of the staterooms are cooled artificially. This is said to be the first case in which staterooms have been cooled with the aid of refrigerating machinery.

The new French submarine torpedo boat "Narval" has serious defects and is not as successful as when first reported, and an order has been issued to cease working on the two sister boats until the defects in the "Narval" have been remedied. The chief difficulty seems to be in changing the motive power from steam, when the vessel is traveling on the surface, to electricity, which is used while she is under water. During the trials it was found that the change was made slowly and was unsafe.

Representatives of Bombay commercial houses have placed orders with several manufacturing firms for American textiles to the value of half a million dollars. The Indians are high in their praise of American goods, and they seem anxious to further trade relations between America and India. A scheme for the establishment of two lines of steamers between Bombay and ports on the Atlantic and Pacific seaboard is under discussion. At present tramp steamers carry all the cargoes that are shipped direct to Bombay.

A large refrigerating plant will soon be erected at Manila. The building will be 250 feet square and 45 feet high and will be located on the bank of the Pasig River. The cooling room will be large enough to contain at once 5,000 beeves, 7,500 sheep and 100 tons of salt meats, butter and eggs, and vegetables enough to supply the American army in the Philippines for some time. The plant will also produce 50 tons of ice daily and 6,000 gallons of distilled water. By means of the railways the troops can be supplied with fresh meat and vegetables daily, and the hospital can be furnished with the best of food and even delicacies and plenty of pure water and ice.

On December 21, the torpedo boat "Shubrick," which was launched October 30, came very near being destroyed. The boat, which is about 90 per cent finished, was lying at the dock at the northern end of the shipyard, where a high trestle of the Chesapeake and Ohio Railway runs parallel with the dock and a few feet from it. A long train came down the incline and some of the cars broke loose and ran down and piled themselves on the top of the trestle, and a box car loaded with seeds dropped into the dock between the "Shubrick" and an ice barge in a space just large enough to miss both the vessels. The car struck within one foot of the "Shubrick."

According to The Engineer, the manufacture of domestic utensils of aluminium is making great strides in India. There are several centers of trade, and the more general adoption of the metal is being hastened by the high price of copper and tin. The School of Arts in Madras, where the work was originally started, has recently filled a large order for cooking vessels for a regiment of infantry. These vessels have, almost of necessity, to be made by hand, since each new regiment has its own patterns. The great difficulty is the production of a suitable water bottle, as the flat pattern is not easily made in aluminium, since soldering cannot be used, while the cylindrical pattern cannot be conveniently carried.

Death of Elliott Coues.

Elliott Coues, the naturalist, died at Baltimore on December 25, and in his demise American science has lost another of her greatest men. He was born in Portsmouth, N. H., in 1842. His father Samuel Elliott Coues was the author of several scientific treatises of great value, so that Elliott Coues the younger came naturally to study science. He graduated from the Columbian University in 1861, and from its medical department in 1863, and entered the United States Army as medical cadet and was appointed by Surgeon-General Hammond as Assistant Surgeon in the United States Army, retaining that office until his resignation in 1881. His first post of duty was in Arizona and then in Colorado and Illinois. In both stations he investigated the natural history of the region and published several important papers. In 1873, he was appointed Surgeon and Naturalist of the United States Northern Boundary Commission, which surveyed the line along the 49th parallel from the Lake of the Woods to the Rocky Mountains. After his return to Washington he published, in 1872, his "Key to North American Birds," and in 1874, "Field Ornithology." His reputation as a naturalist now became thoroughly established and he was appointed as secretary and naturalist of the United States Geological Survey under the late Dr. F. V. Hayden. He edited the publications of the Survey from 1876-1880, meanwhile conducting explorations in the West. He published "Birds of the Northwest" in 1874, "Fur-Bearing Animals" in 1877, and "Birds of Colorado Valley," 1878. He was ordered by the War Department to the frontier, but his services to science were so important that he tendered his resignation and continued his scientific career. He was a member of most of the scientific societies of the United States and many of Europe. He was elected to the chair of anatomy at the National Medical College, in Washington, and pursued some of his favorite studies for ten years, teaching human anatomy upon the broad basis of morphology and upon the principle of evolution.

A Great Collection of Fossils.

The American Museum of Natural History is most fortunate in acquiring, through the generosity of President Jesup, the second half of the Cope collection of fishes, amphibians, and reptiles brought from Kansas, Colorado, Wyoming, Montana and other sections of the West between the years 1867 and 1896. In 1895 the first part of this collection was presented to the Museum by the trustees, so that now the entire life work of the great archæologist, the late Edward Drinker Cope, will be permanently represented here. The collection is a most remarkable one and would give celebrity to any scientific museum in the world, as it practically covers the history of life upon the North American continent for a vast period of time. The new collection, it is expected, will be sufficient to fill one of the large new exhibition halls. The proceeds of the sale of the collection will form an endowment fund for a professorship of natural science in Philadelphia.

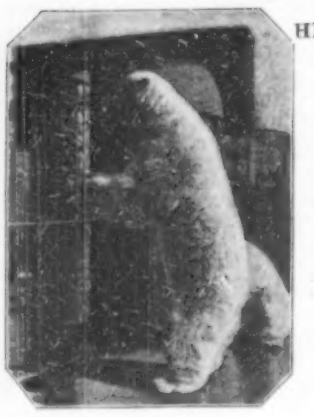
Preserve Your Papers.

By taking a little trouble, when a paper first comes to hand, it may be kept in a way to form a permanent and most valuable addition to the reading matter with which all families and individuals should be supplied. We furnish a neat and attractive cloth board binder, which will be sent by mail prepaid for $1.50. It has good strong covers, on which the name SCIENTIFIC AMERICAN or SCIENTIFIC AMERICAN SUPPLEMENT is stamped in gold, and means by which the numbers may be securely held as in a bound book. One binder may thus be made serviceable for several years, and when the successive volumes, as they are completed, are bound in permanent form, the subscriber ultimately finds himself, for a moderate cost, in possession of a most valuable addition to any library, embracing a wide variety of scientific and general information, and timely and original illustrations. Each binder holds two volumes, all the numbers for one year. Save your papers!

A REQUEST has been made to the trustees of Princeton University to allow the valuable apparatus shown in our issue of December 23 to be placed on exhibition at the Paris Exposition. The instruments, which include the great magnet and the induction coil, are of great value and are of enormous importance in the history of American science, and it is gratifying to note that the trustees have decided not to allow them to be sent to the Exposition. The loss of the Volta relics at Como was a public calamity.

EXPERIMENTS with wireless telegraphy at Orange River, in South Africa, have been most successful. Perfect communication was maintained with De Aar, 70 miles distant.

NEW YORK ZOOLOGICAL PARK



THE city of New York is rich, from an educational point of view, in the possession of its Museum of Natural History, its Museum of Art, its Zoological Park, and its Botanical Garden. No city in the world, with the exception of London can boast of a finer group of institutions. The love of seeing strange animals and noting their behavior seems inherent among all civilized peoples. The function of the Zoological Park is two-fold: First, it affords an opportunity for studying animals under conditions which will approximate in some degree their habitat; and secondly, afford pleasure to vast throngs who care little for the scientific side of natural history. The New York Zoological Park admirably performs this two-fold function. The scientific aspect is kept carefully in view, but the public at large are warmly welcomed to visit the collections, and they have not failed to appear in large numbers on every pleasant day since the opening of the park.

The New York Zoological Society was incorporated in 1895 under a special charter granted by the Legislature of the State of New York, the declared object of the society being the maintenance of a public zoological park, the preservation of our native animals and the promotion of zoology, and the society has now 700 members. After its incorporation the society proposed to the city that 261 acres of land in Bronx Park should be set apart as the Zoological Park of the City of New York. The city officials approved of the plan, and, in brief, arrangements were made as follows: The society was to build the animal buildings and to furnish the animal collection at a cost of not less than $250,000. These buildings were to become the property of the city by gift of the society and the city in turn agreed to furnish the ground required, prepare it for occupancy, and maintain the Zoological Park when established. The terms of the grant are equitable and the results cannot fail to prove of lasting benefit both to the society and the people of Greater New York. Like the Museums of Natural History and Art, the Zoological Park is due to individual initiative. Private citizens of generous means and public spirit have provided the nucleus, while the city really becomes a partner in the enterprise, to the extent of a part of the cost and a share in all its benefits.

To make sure of meeting all scientific requirements, especially the needs of the animals, two of the leading zoological experts of the country carefully examined the schemes for the development of the park in connection with the plan, and it was found that on the whole the ground selected for the park could hardly be better adapted to the end in view. It was surprising to find so near the built-up portion of the city a tract combining such natural beauty and ruggedness, such an abundance of mature forest trees, such an unlimited water supply and sufficient diversity of local conditions to meet the needs of nearly all the animals that it is desirable to exhibit in a zoological park. It is curious that a park with such splendid natural advantages could lie for so long a time practically unknown, and certainly wholly unappreciated.

In July, 1898, when the Zoological Society assumed control of the 261 acres forming the southern portion of Bronx Park, the site was an unknown wilderness almost as wild as the heart of the Adirondacks. It was a jungle of ragged forest, brambles, bushes, and tall weeds. There were three extensive bogs, in any one of which an elephant might easily have become entombed. The site at first would seem discouraging; poison dogwood and poison ivy grew in many places, an open sewer flowed very nearly half a mile on the surface; and there was not a drop of drinking water available, nor a seat or shelter of any kind. The Department of Parks has, however, accomplished wonders, and many of the nuisance spots have now become beautiful parts of the inclosure. The city has now laid an extensive series of walks, water pipes, sewers, and roads and has installed important drainage works, pond excavations, etc., until today more than one-half of the whole inclosure is in excellent condition.

As we have already stated on another occasion, the Botanical Garden occupies the northern end of Bronx Park, and the Zoological Park the southern end. The extreme length of the latter from north to south is 4,950 feet and its extreme width is 3,120 feet. It is roughly estimated that one-third of the land area is covered by heavy forests, one-third by open forests, and the remaining third consists of open glades and meadows. It is largely composed of granite ridges running from north to south and in places their crests are denuded. There are two important bodies of water, Lake Agassiz and Bronx Lake, whose combined area is more than 30 acres. Five of the principal basins in the park and bogs have been converted into ponds for the use of various animals. The crowning glory of the Zoological Park is the magnificent forest growth which covers about two-thirds of its area, and it should be said that only a portion of the available territory has at present been inclosed, the remainder being open to the public at all times, and it is safe to say that nowhere else, within 50 miles of New York, can there be found any more beautiful forests than those in the central and eastern portions of the park. The society has determined that all this should be kept, as near as possible, in its primeval condition, and the work of caring for it is in charge of an expert forester. Although in the corporate limits of the city of New York, the park is not really as accessible as it should be, but it can be reached from the City Hall by means of elevated and trolley railways in one hour, at an expense of eight cents, and it can also be quickly reached by the Harlem steam railroad from the Grand Central Depot. Unfortunately, access to each of the three entrances requires a considerable walk, but in time omnibuses will be run, the fare being nominal.

It should be remembered that the park is but one-third of the way toward completion, but it is interesting to see what remarkable advance has been made in one year of active work and two years of planning and organization. Let us now enter the park at the Southern Boulevard and Pelham Avenue. The first ranges are those devoted to the fallow deer, the axis deer, the mule deer and the black-tailed deer. The ranges are of ample size and are provided with a high fence of hard steel wire so strong that no animal can break through it and yet so light as to be actually invisible at a distance, thus avoiding the disfigurement of the park. Each range is provided with a shelter house for its occupants and also one or more macadamized yards or corrals into which the herds are driven whenever the ground in the ranges is so soft from excessive rains that the turf is liable to be seriously damaged by their hoofs. The deer are naturally one of the most attractive animals which can be exhibited. A winding path now leads to the Aquatic Birds' House, the Flying Cage and the Ducks' Aviary. The first is the result of an attempt to solve an old problem in a new way, the care of large migratory water birds in the most uneven winter climate in the world. The building is admirably adapted for its purpose, and like all of the other structures in the park was built by Heins & La Farge, architects. The building is 63×50 feet, and its whole central area is occupied by a large cage 16 feet wide, 38 feet long and 16 feet high. It is filled with a choice mixed collection of flamingoes, pelicans, swans, egrets, storks, ibises and ducks. The bottom of the cage contains a spacious pool of running water. Along the side of the building are two rows of cages, and on the exterior of the building there are two more series of large cages at present occupied by eagles, vultures and other birds of prey.

Case Containing Snakes and Living Plants.

Between this building and the Ducks' Aviary the great Flying Cage is being completed. This is indeed one of the wonders of the Zoological Park. It represents an attempt to do for certain large and showy water birds precisely what has been done for the hoofed animals, the buffalo, the otter and other species—to give them all a section of nature's own domains; and when the birds are finally put into the cage they will fly in real freedom, for it incloses three forest trees of considerable size. The structure is 152 feet long, 72 feet wide, 55 feet high, and consists of a series of steel pipe arches and purlins over which wire netting has been tightly stretched; chain netting is used so as to afford the least possible obstruction to the eye. It contains a pool of water 100 feet long and an abundance of shrubbery. The Ducks' Aviary is 250 feet long by 143 feet wide and consists of a pond containing three islands, two of which are subdivided by low fences of wire netting into twelve separate inclosures. In the central portions of the southern island stand two rustic shelter houses, each of which furnishes shelter for the occupants of the four yards, so that each inclosure is provided with its own section of pond, grass bank, gravel banks, sanded runways, shrubbery, earth and a dry rat-proof shelter house. The fence is of peculiar construction; it consists of a rat guard which might be likened to a letter J turned upside down and attached to a letter I. This will prevent dogs, rats and weasels from passing through the fence. Beyond the Bird House are the Red Deer Range, Caribou Range and the Moose Range, and to the left of these will be built the Lion House, the Monkey House, etc., which when constructed will undoubtedly prove of the greatest popular interest. The path then leads by the elk range, which is of large extent, and one of our photographs represents a group of those beautiful animals taken in the range itself. Next to the Elk Range are the dens for the wolves and foxes, and the Aquatic Mammals' Pond lies just below these dens. Nearby the prairie dogs have a circular "Village" 80 feet in diameter, sur-

Grizzly Bear Cubs.

NEW YORK ZOOLOGICAL PARK.

rounded by iron fences with an overhang and with walls going down to bedrock, so that there is little danger of their escape. It contains fifty fat, jolly little prairie marmots. There are also ranges for moose, prong-horned antelopes and buffalo. The Buffalo Range is of large area, comprising 20 acres of rolling meadow amply provided with shade trees. The Buffalo House is a rustic hillside barn 80 feet in length, and its flat roof is open to the public and is intended as a convenient look-out over the main range and corrals. An engraving represents the buffalo herd, which has been "rounded up" by an accommodating keeper.

From the Buffalo House we pass to the Bear Dens, passing the Rocking Stone, a colossal cube of pinkish granite, a pressure of fifty pounds exerted on one angle of which causes its apex to swing north and south about two inches, notwithstanding the fact that it weighs thirty tons. The Bear Dens are most interesting, and at present contain grizzly bears, black bears, and polar bears, the latter being great favorites on account of their being showy and active. In one of the cages are the sea lions, which are also showy animals who are constantly "on exhibition," diving, swimming, climbing, and hopping about, and no one within a quarter of a mile of them need inquire where they are, for their loud and cheerful "hook!" "hook!" is heard far and wide.

The Reptile House, which is the second important building, is one of the finest structures ever erected in a zoological garden. It is 146 feet long, and its greatest width is over 100 feet, and it cost about $45,000. It is constructed of mottled brick combined with granite and Indiana limestone. It has an ornamental cornice of terra cotta modeled by A. P. Proctor. The great central hall is unbroken by a single column, and at one end it opens across the crocodile pool into the green jungly mass of the conservatory. Nearly the whole of the tropical vegetation came from Florida along with the five alligators, the first occupants of the pool. No other zoological garden in the world has such a unique and beautiful feature in a reptile house. In the center are shallow water and salt water tanks for terrapin and marine turtles. The whole of the main hall is devoted to reptiles of the tropical zone, and the large serpents and lizards occupy one side and one end in large cages, while around the other sides are serpents and small reptiles in neat little cages with living plants, as shown in one of our engravings. Reptiles of the temperate zone are kept in a small wing which forms the entrance. The scientific museums of the United States are rich in animal collections of almost every description but reptiles and amphibians, so that the American public now has an opportunity, as nowhere else in the country, to study living reptiles.

There are at present 157 species of live animals represented in the collections, and the number of specimens is 843, 157 being mammals, 175 birds, and 511 reptiles. Up to the opening of the park on November 8, 5¼ miles of wire fence were erected, 2,470 feet of wrought iron fence were built, 9,750 feet of walk were constructed, and the installations and collections in the park have cost the society the sum of $144,227. It will require two more years of active construction to carry out the society's programme and to provide the buildings that have been planned. Among the buildings and installations for animals which are outlined in the society's programme are the Antelope House, the Administration Building, the Monkey House, the Lion House, the Bird House, the Elephant House, the Pheasants' Aviary, the Eagles' and Vultures' Aviary, the Polar Bears' Pool, the Small Mammals' House, etc.

Hon. Levi P. Morton is president of the Zoological Society. Prof. Henry Fairfield Osborn, of Columbia University, is vice-president and chief executive officer, and to him great credit is due for the success that has thus far marked the progress of this undertaking. Mr. Madison Grant is the general secretary of the society, and from its incorporation has labored unceasingly in its behalf.

The director and general curator of the Zoological Park is Mr. W. T. Hornaday, who is well known for his writings on natural history, taxidermy, and his work in the United States National Museum. Mr. Hornaday is assisted by Raymond L. Ditmers, assistant curator in charge of the reptiles, Mr. J. Alden Loring, assistant curator in charge of the mammals, and Mr. Charles W. Beebe, assistant curator in charge of the birds. The park is open to the public on all holidays, Sundays, and week days, with the exception of Mondays and Thursdays in summer, and it is open these latter days upon the payment of an admission. In summer the gates will be opened at nine o'clock in the morning and in the winter at ten o'clock, and they will be closed a half hour before sunset.

MOTOR-WHEEL FOR VEHICLES.

One of the latest and most original developments of the automobile is a motor wheel, which has recently been patented by Mr. J. W. Walters, of 302-306 W. 53d St., New York. The new device stands in a class quite by

Fig. 1.—A DETACHED MOTOR-WHEEL, SHOWING THE MOTOR, FLY-WHEEL, AND STEERING GEAR.

itself, as will be seen from the accompanying engravings, one of which shows the wheel with its motor and steering gear attached to a wagon, and the other the same motor wheel unattached. In a certain sense it may be likened to the steam locomotive; for it is entirely self-contained, and although it cannot run alone, and serves to support a part at least of the load which it draws, yet it bears much the same relation to the wagon, carriage, or other vehicle to which it is fitted as the locomotive does to its train.

The motor wheel consists essentially of a heavy wheel which is journaled in a stout yoke or forks, the head of which turns in a socket. The arrangement is similar to the front wheel and forks of a bicycle except that, instead of being controlled by a handlebar, the wheel is steered by a hand wheel, shaft and gear wheels, as shown in the illustrations.

To the right hand fork is attached a two-cylinder gasoline motor, and two gasoline tanks are carried on the other fork. The wheel is driven through a loosely mounted pinion, which meshes into a gear that is bolted to the spokes of the wheel, and a clutch mechanism, the lever for operating which is within easy reach of the driver of the wagon. The two cylinders are carried horizontally, one on each side of the fork, with the crank shaft, upon which is keyed a flywheel between them. The motor wheel is built in various sizes, from one horse power, suitable to a bicycle, up to four horse power for a carriage, or ten or more horse power for a heavy dray or truck. In attaching the motor wheel to any existing vehicle, it is merely necessary to remove the framework of the front wheels and bolt the steering socket to the body of the wagon, as shown in Fig. 2. When the motor-wheel is applied to a light vehicle, it is attached in front, thus transforming the same into a tricycle. In the case of hansom cabs, it is attached at the rear. When it is applied to the heavier vehicles, such as express wagons, coal carts, etc., two idle wheels are attached to the motor-wheel and work in unison with it.

One material advantage claimed for this system is that no reversing mechanism is necessary, the motor always running in the forward direction. If it is desired to back the car, the motor wheel is turned completely around in the steering socket and the motor started. It will be noticed that as the motor wheel is entirely self-contained and has a single point of attachment to the car, none of the twisting strains, due to the irregularity of the road, are thrown upon the motor; moreover, in case of disablement of car or motor, the ease with which a change of motor-wheels from one car to another can be made conduces to facility and rapidity of repairs.

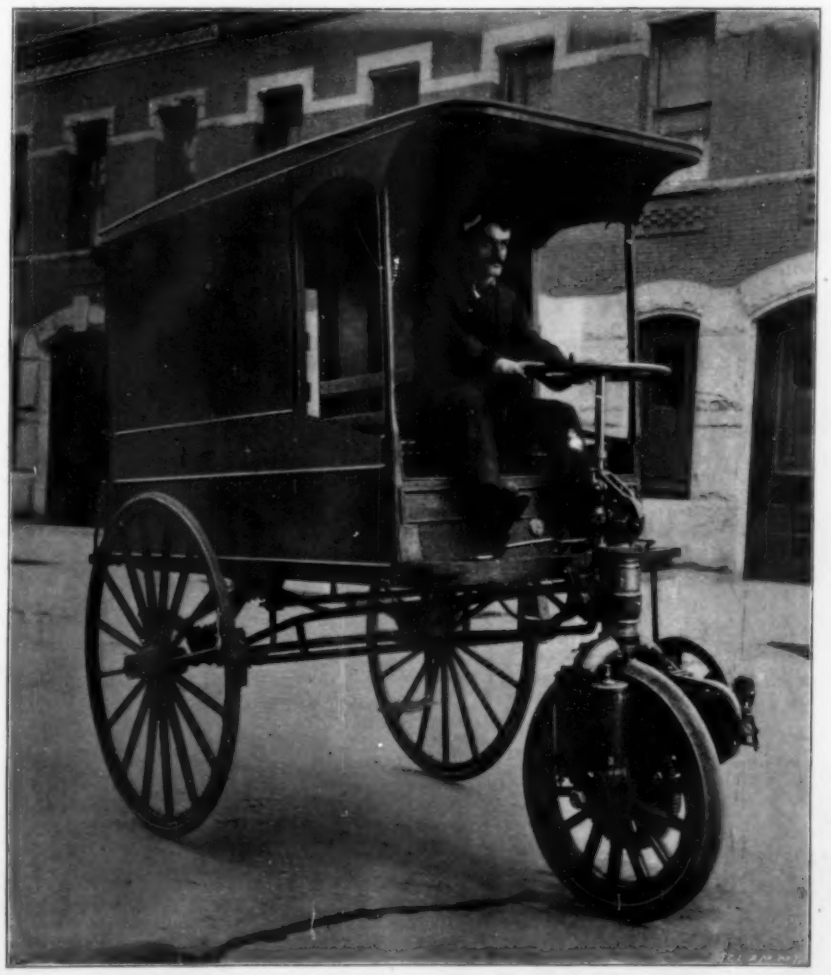


Fig. 2.—THE MOTOR-WHEEL ATTACHED TO A LIGHT WAGON.

The January Building Edition.

The January number of the Building Edition of the SCIENTIFIC AMERICAN is one of the handsomest numbers of this periodical which we have ever issued. The colored cover shows a colonial residence at Summit, N. J., and the houses in the body of the paper are of all prices and are accompanied by plans and interior views. A special feature of the Building Edition is the publication each month of illustrations of fine buildings or pieces of sculpture at home and abroad. These will appeal to all persons of culture, as the illustrations are reproduced exquisitely, and many purchase the paper on this account. The present number contains an article on Italian gardens accompanied by four beautiful illustrations reproduced on a large scale. The editorials refer to "The Building Code of New York City;" "Exhibition of Handicraft;" "Garden Cities;" "A Move for Better Tenements." We shall be pleased to send an earlier sample number of our Building Edition free to those of our new subscribers who may not be familiar with this beautiful and unique periodical.

The Current Supplement.

The current SUPPLEMENT, No. 1253, is an unusually interesting number. "Long-Span Bridges," by Professor W. H. Burr, of Columbia University, is continued. Like the preceding installments, the paper is elaborately illustrated. "Progress in Mechanic Arts in the Last Three-Quarters of a Century" is by Dr. Coleman Sellers, and is continued in this issue. "Electrical Vehicles and Their Relation to Central Stations" is by H. M. Maxim. "The Scientific Work of the U. S. Department of Agriculture" is a résumé of the report of the year. "A Jib-headed Mainsail Sloop Ice Yacht" is by H. Percy Ashley and is accompanied by working drawings.

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RECENTLY PATENTED INVENTIONS.

Bicycle-Contrivances.

BICYCLE.—Henry F. Henderson, Ames, Colo. The bicycle is driven by a chainless gear, the novel feature of the invention being found in the use of a fly-wheel connected with the center of a driving hub on the rear wheel. When motion is imparted to the pedal-shaft the driving-hub will be rotated in a backward direction, carrying the fly-wheel; at the same time the wheel-hub will be rotated in a forward direction. The inventor claims that when the bicycle is once started, the flywheel being in rapid rotation, will steady the bicycle and aid in carrying the pedals over dead centers, thus relieving the rider of much strain.

Railway-Appliances.

CAR.—John M. Jones, Sedalia, Mo. The purpose of this invention is to provide a system of bracing railway-cars which will render the floor more secure and which will, therefore, tend to strengthen the whole structure of the car. The car has needle-beam truss-rods anchored at the transoms of the car. Struts project down from the middle-beams and carry the truss-rods. Stanchions are mounted on the transoms, and truss-rods are supported on the stanchions and anchored at their outer ends to the end-sills of the car and at their inner ends to the middle-beams directly at the struts.

GRAIN-DOOR FOR FREIGHT CARS.—Edward W. Morten, Farmersville, Tex. Adjacent to the door-opening of the car are two track beams. A grain-door is provided, formed in two sections, arranged one above the other, the upper section bearing on the lower section, and the lower section bearing on the sill of the car. When the sections of the door are closed over upon the other and are in engagement with the track-beams, the inclined upper and lower surfaces of the track-beams and battens will force the door inwardly to a firm engagement with yielding strips, in the nature of weather strips, thus effectually preventing any grain from working out of the car when the door is closed.

Miscellaneous Inventions.

PRINTING ATTACHMENT FOR ROLL-HOLDERS.—Gustave H. Schubert, La Porte, Cal. This invention provides an attachment for rolls of wrapping-paper, by means of which it will be possible to print the paper with an advertisement or other matter as the paper is unwound from the roll. An arm is attached to the frame of the roll-paper carrier and pressed by a spring toward the roll of paper. The arm carries an inking and an impression-roller, the latter bearing always against the paper, so that as the paper is unwound from the roll it is impressed with the printing or impression-roller.

COFFEE-POT.—Archibald Angus, Manhattan, New York city. The purpose of the invention is to construct a coffee-pot so that its parts may be readily detached from one another for cleaning purposes. The pot has a bracket hung upon its rim and an upper and a lower member each provided with a hole adapted to register and to receive an arm upon the percolator by which the percolator is suspended. This construction is especially adapted for use with earthenware pots, as it is not necessary to use rivets.

TRANSOM-LIFTER.—George Bickelhaupt, Manhattan, New York city. This transom-lifter is arranged to lock a sky-light or sash or to swing it open for the escape of persons when the building is on fire. The lifter comprises a guideway on the transom, in which guideway friction-rollers on a lever travel. A sliding, spring-pressed catch on the lever engages the guideway to lock the transom in its open position. A rope is connected with the lever and catch permits the catch and lever to be withdrawn and enables a swinging motion to be given to the lever.

WASHING AND CLEANING DEVICE.—Thomas J. Whalen and John F. Warner, Portland, Ore. In this washing and cleaning device a reservoir is mounted, having a partition extending from the upper end of the reservoir downward to form two compartments in communication with each other at the bottom, one of the compartments having a discharge-opening at the upper end. The arrangement is such that the water is discharged by the operator, giving a quick jerk in a downward direction to the device. A rubber-scraper and a felt washer are provided, both projecting a suitable distance from their holders and standing at an angle to each other and at angle to the handle of the device, in order that they may be applied at the proper angle to the surface to be cleaned.

FOLDING UMBRELLA.—Frank G. Grove and Frank E. Stover, Luray, Va. The invention provides an improved locking connection between the telescopic or sliding members of a rib employed in folding umbrellas. The locking device serves materially to strengthen the rib to which it belongs, where the two members of a rib connect, especially when the umbrella is opened. Although it be impossible to move the members of the rib upon one another when locked, they can, nevertheless, be freely operated when the umbrella is closed. The cover of the umbrella when stretched, will, by flexing the ribs, bind the locking device so as to prevent its accidental displacement.

COMBINATION-TOOL.—Wilford A. Hauger, Pax, Mo. The tool comprises a handle-bar in one end of which a headed stock is adjustably held, having a ratcheted head adapted to engage a pipe. A chisel is adjustably mounted on the handle-bar and is movable toward and from the stock. The tool can be employed as a bolt-holder in screwing or unscrewing a nut, as a wire-stretcher, as a pipe-wrench, or as a nail-puller.

TRAP.—John D. Olinger, Fincastle, Ky. This invention provides a simple and efficient trap for large or small game, which trap may be easily set and which, when sprung, will securely hold the captive. It is impossible for the captured animal to release itself by means of its teeth. The trap is so constructed that a touch upon the trigger will be sufficient to cause the sliding jaw to be immediately released and forced to a retaining engagement with the animal upon the trigger.

ROD OR FIXTURE FOR SASH-CURTAINS.—Frank Perry, Brooklyn, New York city. The fixture has a receiving-arm provided with a notch, which arm engages the vertical bore of a head. A horizontal bore communicates with the vertical bore; and an invisible locking bolt sliding in the horizontal bore locks the rod to the fixture, by engagement with the notch in the arm.

COMPRESSED-AIR WATER-ELEVATOR.—William H. Shaffner, Louisiana, Mo. In this water-elevating apparatus a tank or chamber is provided having a water inlet and an outlet and supplied with air under pressure. A valve commands the water-inlet and is held closed by the interior pressure in the elevator. An air-valve commands the air-outlet; and a connection between the water-valve and the air-valve actuates the air-valve by the movement of the water-inlet valve. The tank automatically receives a charge of water and automatically regulates the escape of air when water is to enter the tank or chamber.

TROUSERS-CLASP.—Avediss B. Herald, 946 New York Avenue, Washington, N. W., D. C. This novel clasp is designed to be used on trousers wrapped around the leg of the wearer by bicyclists who seek to avoid the danger of loose trousers. The trousers having been folded as usual, the clasp is applied, the base-section of the clasp fitting within the trousers-leg and the clamping section of the clasp in the loop formed by the fold and securing the fold by its tension toward the base-plate.

THILL FOR VEHICLES.—Charles A. Ray, Bridgewater, S. D. This thill is so constructed that while the cross-bar when moved rearwardly may be disengaged from the couplings, it is impossible to disconnect the cross-bar when tension is applied thereto in a forwardly direction, as forward tension or draft on the cross-bar will but tend to hold it the more firmly in the couplings. In order to prevent the cross-bar's being accidentally detached from the thills should it be struck by the hoof of an animal. Set screws are passed through the lower jaws of the couplings into recesses formed in the under faces of the tenons.

WORK-BOX.—Emma Benton, Butte, Mont. This work-basket for holding buttons, spool-thread, scissors, and the like, has a central compartment or body portion on which the basket rests and by which it is supported. Outwardly-overhanging spool-holders are supported by the central compartment or body portion and are attached to the upper portion thereof. The spool-holders are raised above the bottom of the central compartment so as to leave a space beneath the spool-holders. The spool-holders have openings in the bottoms thereof through which may be passed the thread from the spools.

FOLDING-COOP.—Carl H. Thomsen and Herman J. M. Jörgensen, Memphis, Tenn. To provide a light, simple coop especially adapted for poultry and capable of being conveniently folded for shipment when empty is the purpose of the present invention. The coop is so made that there are no parts to be removed, undone, loosened, swung, or in any way moved in order to form the coop. Consequently no pieces will be lost, broken, or misplaced. In its construction, the coop consists practically of three parts: a bottom section, a top section, and a connecting link section, the top section being adapted to fold down upon the bottom section.

FOLDING GO-CART.—Elisé Defersenaire, Manhattan, New York city. The go-cart has sides connected to move toward and from each other, to which handle-bars are joined. A transverse bar extends between the handle-bars and is removably connected therewith. When the vehicle is folded, the transverse bar forms a handle. The cart may be extended rigidly into operative position or folded compactly when not in use.

WATER-WHEEL.—Patrick Henretty, Mankato, Minn. The water-wheel comprises pulleys provided at intervals with peripheral sockets. The bucket-chain used consists of a series of buckets equally flared on both sides of a central line and provided at their juncture with eyes. Through the overlapping eyes of adjoining buckets a shaft is passed, provided alongside of the buckets with rollers operating in the sockets of the pulleys. Links connect adjacent shafts outside the rollers.

Designs.

CIGAR BOX-LID HOLDER.—Alexander W. Grelle, Logansport, Ind. The leading feature of the design consists of a U-shaped clip having one of its flanges provided with an extension bent outwardly in its lower portion and with a rib on the outside of the extension.

WALL-PAPER.—Harry Wearne, Rixheim, Germany. The papers which form the subjects of the three present designs are decorated with flowers of various kinds tastefully combined in panels.

INCANDESCENT-LAMP SOCKET.—Rudolph Meyer, Brooklyn, New York city. The socket is made of porcelain and provides a simple means for making the contacts.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS ETC.

Die Eisenkonstruktionen der Ingenieur-Hochbauten. Ein Lehrbuch zum Gebrauch an technischen Hochschulen und in der Praxis. Von Prof. Max Foerster. Erste Lieferung. With 174 illustrations and 1 plate. Leipsic: Wilhelm Englemann. 1899. Small quarto. Pp. 112. Price, paper $2.

Most German text books on iron framed structures have long outlived their usefulness; a new work in which the principles of modern engineering are concisely and yet exhaustively explained is certain to meet with success. The book which lies before us comes from the pen of a man evidently well qualified to fill the wants of German students. He has written a text book which is characterized by a carefulness of preparation and clearness of demonstration which we find almost invariably in the works of German scientists. We trust that the remaining installments of Prof. Forester's book will at least equal the first part. A feature of the book which deserves especial mention is the bibliography which concludes each chapter.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

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Notes and Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7780) F. C. S. asks for a process to prevent sweet cider from souring. A. When the cider has reached the flavor required, add 1 to 2 tumblers of grated horseradish to each barrel of cider.

(7781) J. Z. asks: Can an open circuit battery be used on an induction coil as well as a closed circuit battery, and what is the difference? A. An open circuit battery can be used in running an induction coil for a time. A closed circuit cell is one which will furnish its current indefinitely or till its materials are used up. An open circuit cell must be allowed to rest very frequently. This the cell gets in running the coil to an extent, since the vibrator opens and closes the circuit alternately.

(7782) J. B. writes: Seeing in your most valuable paper an article headed "Eyesight of Children," I have long wondered why all writers, including the celebrated "Webster's Unabridged," use the word at all, unless to distinguish between foresight and hindsight. Why not say "my sight is poor" instead of my "eyesight, etc."? Is there any justifiable grammatical reason for it? A. If our esteemed correspondent can induce people to abandon the use of the very old word "eyesight," the dictionaries will then mark it "obsolete" or drop it out. Till that time it must be inserted, since the office of a dictionary is to give the words of a language as they are used. The people make a language, the dictionaries record that usage. The fault lies with the people, if any fault is to be found. If disposed to be critical with our correspondent, we should ask why he includes "Webster's Unabridged" as a writer. A dictionary cannot be called a writer.

(7783) C. K. asks (1) how to harden the horseshoe magnets for the D'Arsonval galvanometer described in "Experimental Science." A. Heat the ends of the steel red hot for about one inch in length, and cool by plunging vertically into water. 2. How to compound lines, I mean about the north and south poles? A. Mark the separate magnets so as to recognize the north poles. Place all the magnets with their similar poles together. They are equivalent to a magnet as strong as the sum of all the magnets.

(7784) C. A. S. asks: Given two bodies of same size but of unequal weight (decidedly unequal) like spheres or cars, started with same initial velocity down an inclined plane, which will have the greater velocity, which will reach the bottom quicker, and which will travel quicker on a plane surface at foot of incline? A. The best answer to this inquiry is, try it and see. That is the way Galileo did nearly three centuries ago. The behavior of the balls on an inclined plane is the same relatively as if they were falling vertically. The air and other friction will retard the lighter body more than the heavier.

(7785) R. E. H. asks: 1. Can you give directions for making the so-called moist water colors? A. Dry colors, mixed with gum tragacanth, will remain moist as desired. 2. In photography exposure tables it is stated that the amount of light depends on the altitude of the sun at the time of exposure; then in the body of the table 1 second is given for March 20, noon, and for June 20, noon, is 2 seconds; while those from September 20 to March 20 appear to be correct, if in direct proportion to altitude of sun, those from March 20 to September 20 appear to be too short. The sun's altitude at noon June 20 is 1·2 times that of March 20, and the exposure should be 0·8 for June 20 to 1 for March 20. The difference between 0·8 and 0·2 seems to me too great for correct exposure. Where can I find a table that is correct? A. You do not give the latitude; but, taking the degree of latitude New York city is located in as a standard, we think the light values given are substantially correct. Comparing the above values with Lieut. W. Very's tables, found on page 201 of "The Scovill Encyclopedic Dictionary of Photography," we find only a slight variation. At noon in March, he advises 1 second; April, 1 second; May, 0·5 second; June, 0·3 second; July, 0·2 second; August, 0·5 second; September, 0·5 second; October, 1 second; November, 1·5 second; December, 1·7 second.

(7786) S. C. asks for process of reclaiming gold from a gold toning-powder containing borax and soda. A. Dissolve the powder in water, then add a solution of sulphate of iron, which will precipitate the gold down in the form of a black powder. The solution is then poured or decanted off and the powder washed and then dried. The powder may now be re-dissolved with nitro-muriatic acid, evaporated and re-dissolved once or twice, when chloride of gold, free from acid, will result. See Scientific American Supplement, No. 377.

TO INVENTORS.

An experience of fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office Scientific American, 361 Broadway, New York.

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DECEMBER 26, 1899,

AND EACH BEARING THAT DATE.

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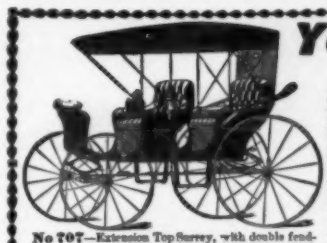

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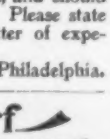

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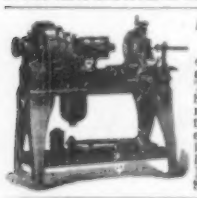

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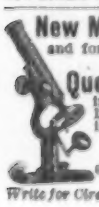

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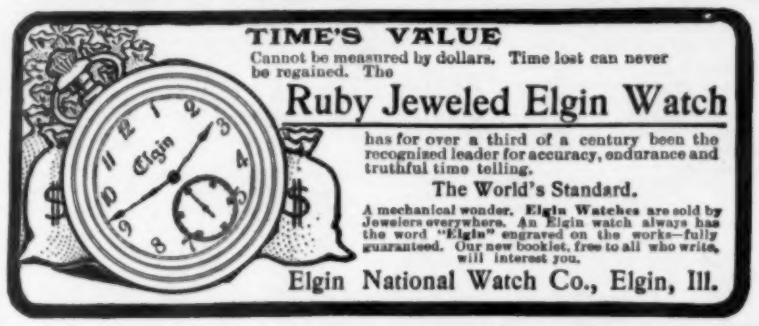

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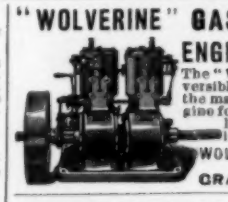

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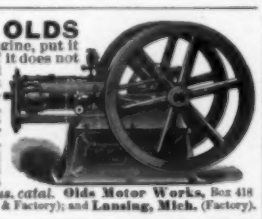

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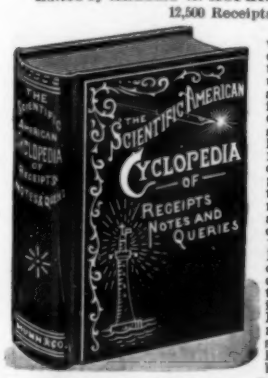

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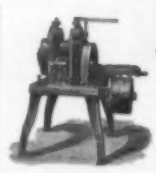

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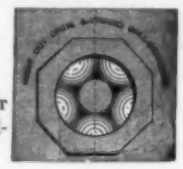

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